Northern Spotted Owl Effectiveness Monitoring
Northwest Forest Plan

Annual Summary Report
2001

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Executive Summary

The 2001 field season marked the eighth year of monitoring northern spotted owl (*Strix occidentalis caurina)* populations under the Northwest Forest Plan. Surveys of the eight demography study areas in 2001 recorded information on occupancy, survival, and reproduction from nearly 1100 spotted owl sites. Spotted owl pairs were present at 52.1% these sites. The percentage of the female owls that nested across the eight areas ranged from 20% to 84.8 % and the number of young fledged per area ranged from 26 to 109. The total number of young fledged was 492, up 30% from the 2000 season.

Work on habitat map development was conducted in the Western Cascades in Oregon under the predictive model development program. The preliminary rule set for the CalVeg map data was developed for the owl habitat map in the California portion of the Klamath Province.

The predictive model development research project completed several data analyses in the Roseburg portion of the Oregon Coast Range and initiated Phase II of the project in the Western Cascades Province in Oregon. There were 2 major tasks to be completed from Phase I that were done at the time of the Phase I progress report: variance components analyses for survival and productivity models, and habitat fitness potential (8_H) estimation. Both of these analyses were finished for the Roseburg BLM study area in 2001. In 2001, survival and productivity modeling was conducted for the HJ Andrews study area, using an aerial photo-based map, the IVMP map, and a satellite image map. The survival modeling is essentially complete, and variance-components analyses for the best-survival model will be the focus of work on 2002.

In 2001, the initial steps were taken toward completion of the spotted owl chapter of the Northwest Forest Plan Monitoring Interpretive Report scheduled for release in 2004. Planning for a workshop to analyze population data was initiated and steps to map and analyze the status and trend of owl habitat maintenance and restoration under the Plan were begun.

Introduction

The purpose of the Northern Spotted Owl Effectiveness Monitoring Plan is to assess trends in spotted owl populations and their habitat relative to meeting the Plan goal. The primary goal is to evaluate the success of the Northwest Forest Plan (the Plan) in arresting the downward trend in spotted owl populations and in maintaining and restoring the habitat conditions necessary to support viable populations of the northern spotted owl on federally-administered forest lands throughout the owl's range (Lint et al. 1997).

The primary objectives of the monitoring plan for these lands are to:

Assess changes in population trend and demographic performance of spotted owls on federally-administered forest lands within the owl's range.

Assess changes in the amount and distribution of nesting, roosting, foraging (NRF) habitat, and dispersal habitat for spotted owls on federally administered forest lands.

The cornerstones of the spotted owl effectiveness monitoring strategy are population and habitat assessment. Integrating data from population and habitat monitoring is being explored through research to develop predictive models (that is, predicting owl population status from the state of the habitat). This report summarizes the activities in fiscal year (FY) 2001 monitoring owl populations, assessing owl habitat and developing predictive models.

Methods

Population Monitoring

Under the plan, the owl population is monitored annually in eight demographic study areas between March 1 and August 31 to determine the occupancy, survival, and reproductive success of the marked owls inhabiting them. Individual spotted owls are located during daytime and nighttime surveys by imitating their call to elicit a response. Once a spotted owl responds, it is observed to determine if it is marked. If marked, the band color /leg banded combination is checked for correspondence with records on the known marked birds at that location. If the observation matches the historic banding record the owl is tallied as present and accounted for. If they do not correspond, the bird is captured and the U.S. Fish and Wildlife Service (FWS) numbered leg band is read to identify the origin of the individual owl. It is counted as present, and its new location is noted. Likewise, attempts are made to capture all unmarked birds and those captured are banded with a color band and a FWS numbered leg band. Each bird encountered is classified as to sex and age-class based upon vocalization, band identification or physical characteristics.

Reproduction information is obtained by feeding individual adult owls live mice and determining whether the owl is a member of a nesting pair based upon the behavior of the owl. If the male is given a mouse and its mate is nesting he will usually deliver the mouse to the nesting female enabling the observer to identify the nest tree. By returning to the nest tree in June and again feeding the adults live mice, the observer can determine if young are present. Counts of number of pairs, number of young fledged and occurrence of marked individuals are made. These data are later analyzed to provide estimates of survival, reproduction and annual rate of population change (lambda).

Habitat Map Development

Province-level habitat maps covering the range of the northern spotted owl will be compiled and analyzed to track the trend in the amount and distribution of habitat. In Northern California, the CalVeg vegetation mapping layer compiled by Region 5 of the Forest Service will serve as the base map for deriving the owl habitat map for that portion of the range. In Oregon and Washington, the owl habitat map will be derived from province-level vegetation maps produced

by the Interagency Vegetation Mapping Project. Rule sets describing owl habitat will be formulated using the attribute information for the respective vegetation maps. Owl habitat maps will be derived from the vegetation maps by applying the rule sets to reclassify the vegetation maps. Habitat map development will track closely with the process for assessing late-successional/old-growth (LS/OG) forest condition and trend since both the owl habitat map and the LS/OG maps will be derived from the same vegetation map products. Owl habitat map development is targeted for completion by the summer of 2003.

Predictive Model Development

The predictive model development element of the monitoring plan is a research effort designed to determine if landscape habitat composition and pattern can be used to predict abundance (occupancy) and demographic performance of northern spotted owls. If landscape composition and pattern are shown to be reliable predictors of owl abundance and demographic performance, then monitoring spotted owl populations may shift, in some areas, to a habitat-based strategy.

The specific objectives of the project include summarizing the abundance and demographic performance of spotted owls at the home range and landscape scales, characterizing landscape composition and patterns for home ranges and landscapes, developing statistical models relating abundance and demographic performance of owls to landscape characteristics for a subset of home ranges in the demographic study areas, validating the statistical models by testing them on the remaining home ranges, and using the statistical models to develop or refine existing spatially explicit models for spotted owls.

Results

Population Monitoring

Occupancy

Owls were surveyed between March and August of 2001 in each of the eight demographic areas. A total of 1,095 sites were surveyed; 571 (52.1%) of the sites were found to be occupied by territorial pairs of spotted owls and an additional 101 (9.2%) sites had resident single owls present (Table 1). Pair occupancy values ranged from a high of 58.6% of the sites in the H.J. Andrews Experimental Forest study area (Oregon Western Cascades Province) to a low of 32.4% in the Cle Elum study area (Washington Eastern Cascades Province).

Table 1. Summary of spotted owl occupancy by demography area for 2001[a]

Demographic	Sites surveyed	Sites with a	Sites with a

area	(*number*)	territorial pair (*number*)	(*%*)	resident single owl (*number*)	(*%*)
Olympic Peninsula	138	68	49.3	20	14.5
Cle Elum	71	23	32.4	5	7.0
H.J. Andrews	162	95	58.6	10	6.3
North Coast	204	94	46.1	30	14.7
Roseburg	131	72	54.9	13	9.9
South Cascades	153	77	50.3	2	1.3
Klamath	142	87	61.3	13	9.1
Northwestern California	94	55	58.5	8	8.5
TOTALS	1095	571	52.1	101	9.2

[a]Preliminary data; values may change in the final analysis.

Reproduction

Survey efforts in March through May of 2001 focused on determining the owls' nesting status. In June through July, those sites identified as nesting were revisited to obtain information on the number of young fledged. Nesting varied across the eight demographic areas: North Coast (Oregon Coast Range Province) was 84.8%, Roseburg was 81.2%, while Klamath and Cle Elum were the same with 73.9% for the percentage of nesting females; the Olympic Peninsula (Olympic Peninsula Province) and South Cascades study areas (Oregon Western Cascades Province) showed the lowest values of only 41.1% and 20.0%, respectively.

Values for fecundity ranged from a high of 0.582 in the Roseburg study area (Oregon Coast Range Province) to lows of 0.108 in the South Cascades study area and 0.029 in the Olympic Peninsula study (Table 2). The total number of young fledged in 2001 (492) was 30% greater than in 2000 (344).

Table 2. Summary of Spotted Owl Reproduction by Demography Area for 2001[a]

	Females Nesting	Young Fledged	

Demographic area	(*%*)	(*number*)	Fecundity[b]
Olympic Peninsula	41.1	42	0.029
Cle Elum	73.9	26	0.480
H.J. Andrews	48.0	81	0.450
North Coast	84.8	109	0.569
Roseburg	81.2	85	0.582
South Cascades	20.0	16	0.108
Klamath	73.9	82	0.500
Northwestern California	53.7	51	0.470
TOTALS	*	492	0.431

[a]Preliminary data; values may change in the final analysis.

[b]Number of female young fledged per territorial female (assumed 1:1 sex ratio of young).

Owl banding and reobservation

Individual owls, without bands, were captured and banded with USGS aluminum, numbered leg bands and colored leg bands in each of the study areas. Previously banded owls were identified by recapture and recording the number on the leg band or frequently, by the reobservation of the colored leg band while the owl was in flight or feeding on prey near the observer. The data collected from banded owls are used in subsequent analysis to determine survival rates, turnover rates, and geographic movements of owls. In 2001, 1,129 adult/subadult northern spotted owls were either initially banded or reobserved. Of the 492 juveniles produced, 467 (95%) were banded and released for future reobservation (Table 3).

Table 3. Summary of spotted owl banding and reobservation by Demographic area for 2001[a]

Demographic Area	Adults/subadults banded or reobserved (*no.*)	Juveniles banded (*no.*)
Olympic Peninsula	70	37
Cle Elum	51	24
H.J. Andrews	196	79
North Coast	203	99
Roseburg	157	83
South Cascades	148	16
Klamath	189	78
Northwestern California	115	51
Totals	1129	467

[a]Preliminary data; values may change in the final analysis.

Pilot Test

A pilot test was conducted in 2001 to transfer field data collection for the Forest Service portion of the Olympic Peninsula demographic study area from the Pacific Northwest Research Station to the Olympic National Forest. The Olympic National Forest had responsibility for hiring and equipping the field crews and the Research Station provided leadership to oversee collecting, summarizing and analyzing the data. This method resulted in high overhead costs and as a result may be a deciding factor in whether having the Olympic National Forest hire and equip the field crews will be continued.

Barred Owls

Several of the study areas reported "increasing numbers of barred owls" (*Strix varia)* and barred owls occupancy of sites previously occupied by spotted owls. In the Olympic National Park portion of the Olympic Peninsula Demography Study Area , barred owls were recorded at 23 sites in 2001. Eight of these detections were pairs. Barred owl reproduction was confirmed at two sites. No hybridization with spotted owls was documented in 2001 in the Park. Further south in the range, in the Klamath and Tyee (Roseburg) Demography Study Areas, over 50 non-juvenile barred were detected in 2001. Reproduction in barred owl pairs was documented as was hybridization between a male spotted owl and a female barred owl. The graph showing numbers of barred owls detected over time in the Tyee Density Study Area is indicative of the trend seen in other study areas (Figure 1).

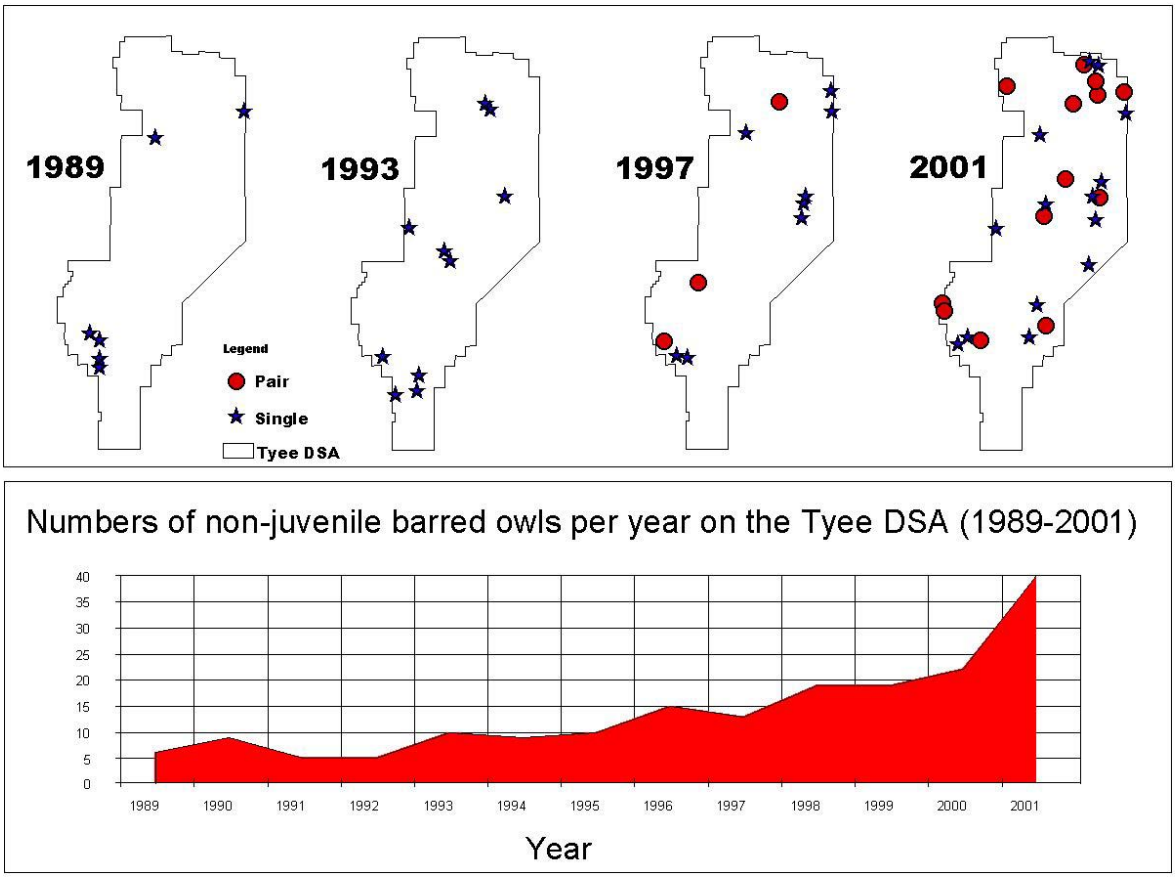

Figure 1. Barred owl detections in the Tyee DSA, Roseburg, Oregon 1989-2001.

Habitat Map Development

An initial rule set describing owl habitat was developed for querying the CalVeg vegetation base map in Northern California and the first draft of a habitat map was produced. Slow progress was made on habitat map development in Oregon and Washington. A vegetation base map was available for the Coast Range, but, based upon preliminary work with the maps through the predictive model development project, it was decided to delay habitat map development in that province until an updated version of the map was available. The model development project also worked with the Western Oregon Cascades vegetation map and reported that it appeared to correlate reasonably well with other habitat map products in comparisons.

Predictive Model Development

There were 2 major tasks to be completed from Phase I that were done at the time of the Phase I progress report: variance components analyses for survival and productivity models, and habitat fitness potential (8_H) estimation. Both of these analyses were finished for the Roseburg BLM

study area in 2001. The variance components analyses were conducted only on the best-selected model for survival and productivity, and thus represent the maximum variability explained by the models. In both cases, habitat variables were obtained from aerial photo based maps. When possible, both spatial and temporal variability in demographic parameters were estimated, and in all cases the proportion of total variability explained by the model, and each of the model components, was estimated.

The amount of variability in survival rates (expressed as a percentage of the total) explained by the best model was 16.0%. More of the temporal variability (30.8%) was explained by climate factors in the model than the habitat variable of the best model that accounted for the spatial variance (14.6%).

The amount of variability in productivity accounted for by the best model was 83.6%, most of which was explained by demographic and temporal factors, including the climate variables.

Habitat fitness potential was estimated by constructing a site-specific stage-structured Leslie matrix for each Roseburg BLM owl territory (n=94), accomplished by estimating age-specific survival and productivity from the best-selected models from each analysis, and using the territory-specific habitat characteristics. Confidence intervals for estimates of 8_H were constructed using the Delta method of computing variances of estimates from other estimates. The results of these analyses will be reported in the Phase II progress report scheduled for completion in FY 2002.

Based upon results of Phase I, use of multiple map sources was continued for habitat variables in Phase II initiated in the Oregon Western Cascades Province. In 2001, survival and productivity modeling was conducted for the HJ Andrews study area, using an aerial photo-based map, the IVMP map, and a satellite image map. The survival modeling is essentially complete, and variance-components analyses for the best-survival model will be the focus of work in FY 2002. The base model development for productivity has been completed, with the next step being the addition of the habitat variables from the 3 map sources also scheduled for FY 2002.

2004 Monitoring Interpretive Report

In 2001, the initial steps were taken that will lead to the completion of the spotted owl chapter of the Northwest Forest Plan Monitoring Interpretive Report scheduled for release in 2004. Discussions were held with the cooperating scientists regarding the scheduling and participation in a workshop in calendar year 2003 to conduct spotted owl status and trend analysis of population data from demographic study areas. Data analyses and summaries from the workshop will provide the basis for the population discussion in the interpretive report. In addition, a team to coordinate the development of province-level habitat maps and subsequent habitat analyses was formed and work was initiated in the Western Oregon Cascades Province. The resulting habitat data will provide information for the interpretive report on the effectiveness of the Northwest Forest Plan in maintaining and restoring spotted owl habitat. Although the report will provide some insight into status and trend of owl population and habitat over the first ten years

of Plan implementation, it will also provide a baseline for comparison of future monitoring results.

Discussion

With the exception of the South Cascades demography area, reproduction was up in all areas in 2001, compared to 2000, as evidenced by increases in fecundity (0.335 overall in 2000 and 0.431 in 2001) and number of young fledged (344 in 2000 compared to 492 in 2001). The South Cascades demography area recorded the greatest swing in values from 2000 to 2001 with a reduction in the percent of females nesting from 82% to 20% and a decline in fecundity from 0.758 to 0.108.

The presence of barred owls and their relationship to spotted owl site occupancy and productivity received continued attention in the monitoring program. These data are gathered commensurate with the spotted owl survey effort, thus the costs for data gathering is minimal and may be important to explaining spotted owl occupancy, or the lack thereof, in otherwise suitable habitat.

The development of province-level habitat maps has been delayed due to the dependence on IVMP vegetation map products. In recent months, IVMP map products for several provinces have been completed and others will be completed by early 2003. With this limitation removed, habitat-mapping workloads will increase significantly in 2002 and 2003 to meet a target completion date for all habitat maps of summer, 2003.

Monitoring Program Considerations

No province or range-wide analyses were scheduled or conducted in FY 2001 for any of the spotted owl monitoring program elements. Information gathered in FY 2001 will be further analyzed in the next meta-population analysis scheduled for December, 2003, and the monitoring interpretive report is scheduled for completion in 2004.

In FY 2002-03, a team of scientists and managers will review the spotted monitoring strategy to assess the adequacy of the information that is being gathered to serve the needs of decision-makers. Findings from this review will be considered in determining the direction for monitoring spotted owls during the second decade of Northwest Forest Plan implementation.

Recommendations for Upcoming Field Season

Population monitoring will continue in all eight demography study areas in 2002. Due to the high overhead cost incurred during the pilot test in the Olympic National Forest in 2001, an

alternative, more cost effective method of monitoring the National Forest lands in the Olympic Peninsula demography was adopted. The field crews for all seven demography study areas in Oregon and Washington will be hired through an agreement between Region 6 of the Forest Service and Oregon State University.

Work in FY 2002 will focus on developing habitat maps in the Oregon Cascades Province and Olympic Peninsula Province under the predictive model study and the habitat map development elements of the plan. Preliminary information indicates that the vegetation map for this area may not have the classification problems encountered in the Coast Range map and thus provide a better opportunity to develop a more accurate algorithm for identifying spotted owl habitat than the Coast Range Map.

Literature Cited

Lint, Joseph; Noon, Barry; Anthony, Robert; Forsman, Eric; Raphael, Martin; Collopy, Michael; Starkey, Edward. 1999. Northern spotted owl effectiveness monitoring plan for the Northwest Forest Plan. Gen. Tech. Rep. PNW-GTR-440. Portland, OR : U. S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 43p.

Key Partners

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Budget Information

Budget information for FY 2001 is provided in the following table.

Table 4. Spotted owl effectiveness monitoring funding by monitoring element and contributing agency in fiscal year 2001

Element name	Funding Agency Contribution (thousands of dollars)								
	USFS				*BRD*	*BLM*	*NPS*	*FWS*	**Funding total**
	Region 5	**Region 6**	**PNW**	**PSW**					**By element or task**
Demographic Areas	415.0	943.4	--	--	--	600.0	140.0	--	2098.4
Habitat map	--	*	--	--	*	--	--	0.0	
Predictive models	--	--	138.6	--	100.0	--	--	--	238.6
Coordination and management	--	--	--	--	--	60.0	--	--	60.0
Funding subtotal	415.0	943.4	138.6	0.0	100.0	660.0	140.0		
Funding total by agency		1497.0			100.0	660.0	140.0	0.0	2397.0

*Habitat map work is being done within the framework of the predictive model element.